


# PRELIMINARY STRUCTURAL CONDITION REPORT

## MAGPIE COTTAGE

## DELGATE BANK, WESTON HILLS,

## SPALDING, LINCOLNSHIRE, PE12 6DN

**PROJECT No: SW26-232**

**DOCUMENT REF: SW26-232-REP-01A**


© Shields Wilson Limited.

## CONTENTS

1. INTRODUCTION ..... 4
2. ROOF STRUCTURE ..... 5
3. 1st FLOOR ..... 5
4. GROUND FLOOR ..... 5
5. WALLS ..... 6
6. OUTBUILDING ..... 7
7. CONCLUSIONS AND RECOMMENDATIONS ..... 7
APPENDIX A (ROOF DESIGN CHECK) ..... 8
APPENDIX B (1ST FLOOR JOIST DESIGN CHECK) ..... 9
APPENDIX C (PHOTOS) ..... 10


© Shields Wilson Limited.

This preliminary report and opinion have been prepared for the purpose stated herein. It has been prepared for the exclusive use of our client Earl Farming and their professional consultants.

This document or any part of its contents shall not be disclosed to any other persons except those specifically mentioned below.

- Local Authority Planning Department
- Local Authority Buildings Control
- Seven22 Architecture Ltd.
- Any other person with the written permission of Earl Farming

This document is issued only to the persons stated above and on the understanding that Shields Wilson Ltd. is not held responsible for the actions of others who obtain any unauthorised disclosure of its contents, or place reliance on any parts of its findings, facts, or opinion be they specifically stated or implied.

Shields Wilson Ltd. have been requested to carry out a visual inspection and subsequent assessment of the existing uninhabited dwelling, Magpie Cottage, Delgate Bank, Weston Hills.


© Shields Wilson Limited.

# 1. INTRODUCTION

We confirm the visual inspection took place on Monday, the 8th of June 2026.

In principle, the building is a traditional brick two-storey dwelling, with a single-storey outbuilding to the rear.
The slate tiled roof is supported by a timber cut roof structure.
The main house is duo-pitched, and the rear outbuilding is mono-pitched.
The first floor is of standard timber joist construction with floorboards and lath and plaster ceiling.

The walls have been constructed from solid masonry with Flemish bonded brickwork to the front elevation and English garden wall bond to the gables and rear elevation.
The bricks to the front elevation differ from what has been used for the other elevations.
The south-facing elevation of the outbuilding has been coated with a sand/cement render.

The original windows and doors to the main dwelling have been replaced with a more recent modern U.P.V.C alternative, other than the arched window on the south-facing gable. The windows and doors to the outbuilding are in a poor, unmaintained condition and will require full replacement.


© Shields Wilson Limited.

## 2. ROOF STRUCTURE

The roof structure to the main dwelling was surveyed, and the existing timber sizes were measured.

The intermedial cut rafters are 45mm wide x 75mm deep at 400mm c/c, which are supported by the tied truss frames at approximately 1.60m centres. These frames have a 70mm wide x 100mm deep raised tie rafters with a 37x220 raised tie.

Analysis and design checks have been carried out (Appendix A) to find that the existing timbers are NOT adequate for current British Standard loadings, with an overstressing of approximately 50%. Therefore, a full scheme of structural remedial works or replacement will be required. It was noted that a modern membrane has been installed below the slate tiles, so it is assumed that the roof has been refurbished, although there were areas where daylight shone through some of the tile gaps.

## 3. 1st FLOOR

The floorboards were lifted in one of the 1st floor bedrooms to expose 50mm x 150mm joists at 400mm c/c, with an approximate span of 3.55m between supporting walls. Design checks on the suitability of these joists to current design code has been carried out and it's found that they would not be suitable as they are over stressed by over 10%. See appendix B for a copy of the design check calculation.

## 4. GROUND FLOOR

The ground floor appears to be quarry tiles laid directly on the sub-strata. Numerous areas of damp were noted in the visible areas that could be inspected.


© Shields Wilson Limited.

## 5. WALLS

Areas of damp were noted at ground floor and first floor levels, together with some horizontal cracking to the rear wall within the tank room above the stairs.

Large areas of facing bricks will need to be replaced due to their poor condition from frost/water damage and rising damp. The headers over the rear bathroom window are covered with ‘duck tape’ therefore, it’s assumed that they are in a very poor condition. The bricks to the front elevation differ from the other elevations and are ‘tooth’ bonded around the corners. This bond appears to have opened at the joint, therefore remedial tie would be required to repair the required bonding.

Together with the repairs & replacement, a full rake-out and re-point with suitable lime mortar will be needed to remove eroded and incorrect mortars and provide a suitable and stable bond to the masonry.

The foundations to the main house walls were exposed, the footing was of traditional brick corbelling down to a depth of approx. 450mm below ground level.

The chimney on the North facing gable had a visible lean into the building.

When inspected from the inside, it was noted that the chimney is constructed off a timber lintel. The lintel is supported off the breasts continuing up from the first-floor room, although it was noted that there was no breast remaining in the first-floor bathroom, leaving the lintel end unsupported.


© Shields Wilson Limited.

## 6. OUTBUILDING

The roof structure to the outbuilding could not be inspected due to the ceiling boards, although it was clearly in a poor condition with visible sagging noted when viewed internally and externally with large areas of water staining to the ceiling panels

The sagging of the roof structure has caused the side walls to spread outwards, with movement limited with the introduction of a remedial tubular scaffold tie. Vertical cracking was noted to the rear elevation masonry above the window up to the mono-pitch ridge level. The footings were exposed and found to be only approx. 400mm below ground level.

## 7. CONCLUSIONS AND RECOMMENDATIONS

Due to the extent of structural remedial works required to the roof structure, chimney, 1st floor joists, masonry and ground floor damp issues, together with a requirement to underpin the structure due to the shallow existing foundation and risk of foundation movement from the influence of adjacent trees, there is clearly an extensive amount of work required to bring it up to a suitable and safe living standard. We feel that the costs of these remedial works will be above any future value of the property in its current form, therefore it is not suitable for an economic refurbishment and we suggest that a full demolition and reconstruction to meet the current Building Regulations Approved documents with a suitable Architect designed dwelling is the more viable option.

For and on behalf of **SHIELDS WILSON LIMITED**

**M Shields IEng AMIStructE** **7th June 2026**

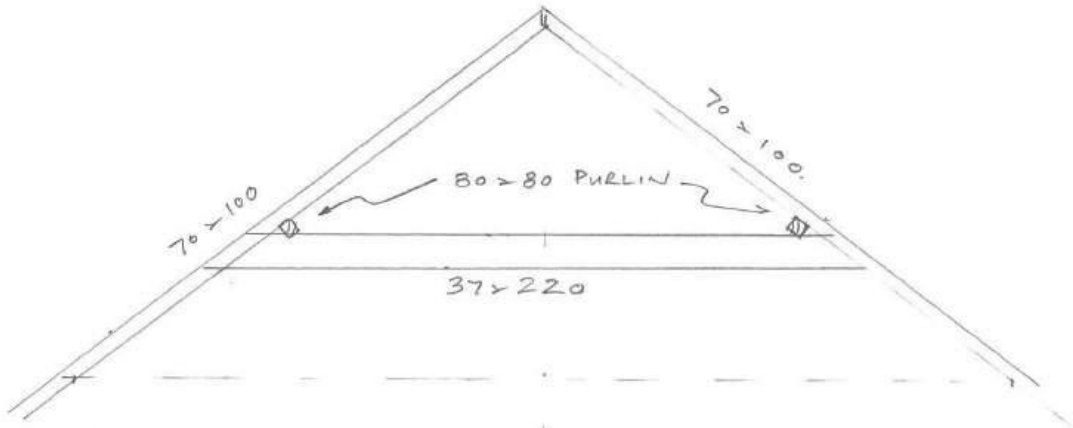

© Shields Wilson Limited.

# APPENDIX A

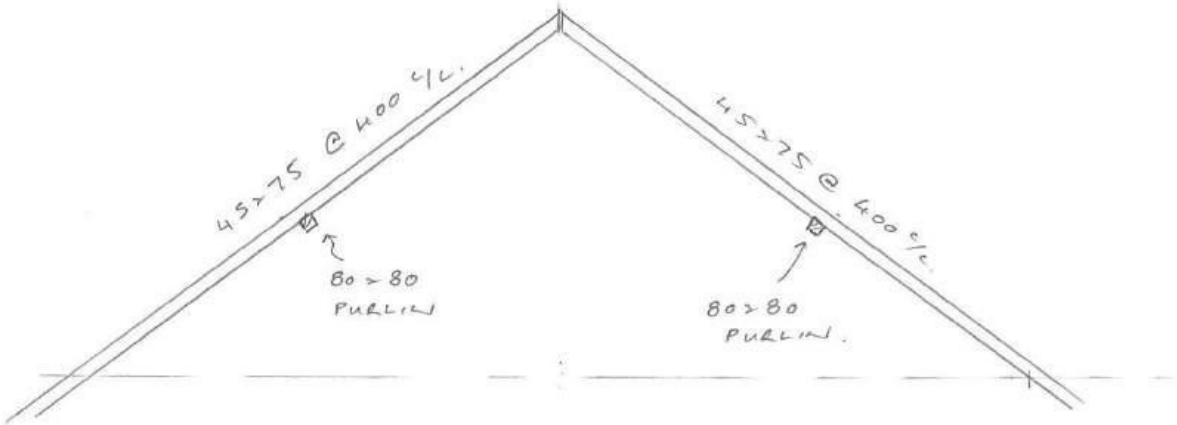

© Shields Wilson Limited.

SHIELDS WILSON
e: info@shieldswilson.co.uk t: 01775 729252
STRUCTURAL AND CIVIL ENGINEERING

| Structural Calculations | Project: MAGPIE COTTAGE | Date: JUNE '26 | Designer: MAS |
|---|---|---|---|
| Project No: 26-232 | Subject: | Sheet No: R/1 | Rev: |




TIED TRUSS @ 1.6m c/c




CUT RAFTERS SUPPORTED BY PURLIN.

Copyright Shields Wilson Limited.

SHIELDS WILSON
e: info@shieldswilson.co.uk t: 01775 729252
STRUCTURAL AND CIVIL ENGINEERING

| Structural Calculations | Project: | Date: JUNE '26 | Designer: MAS |
|---|---|---|---|
| Project No: 26-232 | Subject: | Sheet No: 2/2 | Rev: |

ROOF LOADINGS

ROOF IMPOSED = 0.60 kN/m²

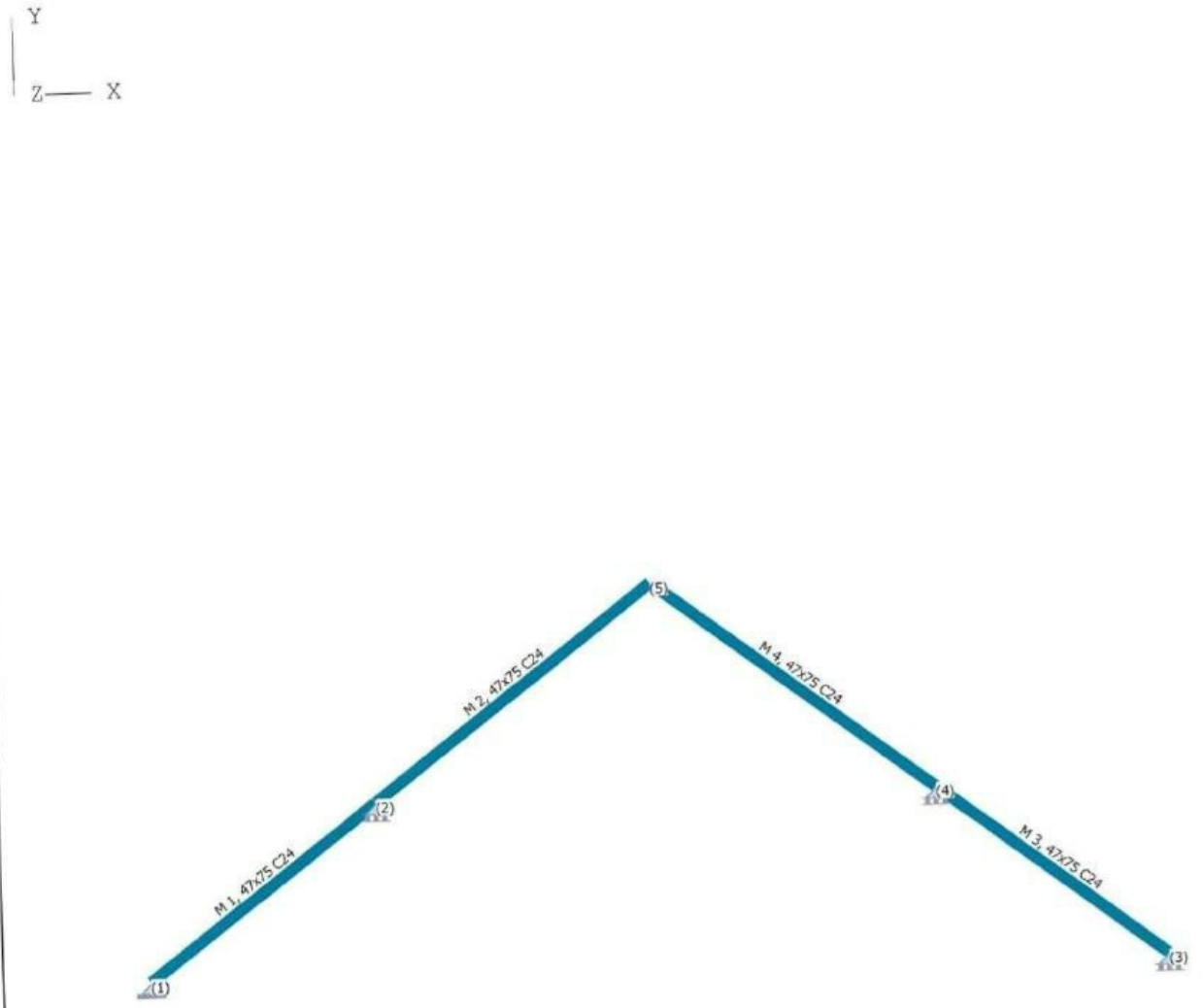
| | | |
|---|---|---|
| SLATES | = | 0.40 kN/m² |
| BATTENS & FELT | = | 0.04 kN/m² |
| RAFTERS | = | 0.10 kN/m² |
| | | 0.54 kN/m² |

Copyright Shields Wilson Limited.

**Shields Wilson**
Bank House
Broad Street
Spalding, PE11 1TB
Tel: 01775 729252

Cloud 98e51

| | |
|---|---|
| **Job Ref** | **: 26-232** |
| **Sheet** | **: R/3** |
| **Made by** | **: MAS** |
| **Date** | **: 10 June 2026 / Ver. 2023.09.15** |
| **Checked** | **:** |
| **Approved** | **:** |




**Frame Geometry - (Full Frame) - Front View**

**Not to Scale**

Software produced by www.MasterSeries.com © Civil and Structural Computer Services Limited.

**Shields Wilson**
**Bank House**
**Broad Street**
**Spalding, PE11 1TB**
**Tel: 01775 729252**

Cloud 98e51

**Job Ref** : 26-232
**Sheet** : R/4
**Made by** : MAS
**Date** : 10 June 2026 / Ver. 2023.09.15
**Checked** :
**Approved** :

# MasterFrame Data File
# Loading Cases and Load Combination

## Load Group Labels

| | |
|---|---|
| Load Group UT | Unity Load Factor (All Cases) |
| Load Group D1 | Dead Load |
| Load Group L1 | Live Load |

## Load Case 001 : Dead plus Live (Serviceability)

| | |
|---|---|
| Load Combination | + 1.00 UT + 1.00 D1 + 1.00 L1 |
| Load Duration | Medium Term |

## Load Case 002 : Live (Serviceability)

| | |
|---|---|
| Load Combination | + 1.00 UT + 1.00 L1 |
| Load Duration | Medium Term |

## Load Case 003 : Dead (Serviceability)

| | |
|---|---|
| Load Combination | + 1.00 UT + 1.00 D1 |
| Load Duration | Long Term |

## The Nodal Co-ordinates

| Node | X (m) | Y (m) | Z (m) | Node | X (m) | Y (m) | Z (m) |
|---|---|---|---|---|---|---|---|
| 1 | 0.000 | 0.000 | 0.000 | 2 | 1.440 | 1.080 | 0.000 |
| 3 | 6.400 | 0.000 | 0.000 | 4 | 4.960 | 1.080 | 0.000 |
| 5 | 3.200 | 2.400 | 0.000 | | | | |

## Member Properties

Members 1-4
M ... ... 47x75 C24 E 10.80E6 G .675E6 TG C24 3021000
A 35.25E-4 Ix 165.2E-8 Iy 64.89E-8 J 259.6E-8

## Member Loading

Member Self Weight Density Load Included in Load Group D1, defined by Modulus of Elasticity

| E kN/mm² | Density kN/m³ |
|---|---|
| >= 200.00 | 77.01 |
| >= 20.00 | 24.00 |
| >= 2.00 | 10.00 |

Members 1-4
D1 UDLY -000.216 ( kN/m )
L1 UDLY -000.240 ( kN/m )

Members 1-4 - MasterFrame Pro Loads
D1 D 010.000 ( kN/m³ )

## Member End Releases

Symbols End 1 torsion-minor-major End 2 torsion-minor-major O Released ® Fixed
2 ®®® ®OO

**Shields Wilson**
**Bank House**
**Broad Street**
**Spalding, PE11 1TB**
**Tel: 01775 729252**

Cloud 98e51

**Job Ref** : 26-232
**Sheet** : R/S.
**Made by** : MAS
**Date** : 10 June 2026 / Ver. 2023.09.15
**Checked** :
**Approved** :

# Nodal Loading and Support Conditions

NODE 1
UT Rs 1 1 1 0 0 0 (Pinned)
NODES 2-4
UT Rs 0 1 0 0 0 0

**Shields Wilson**
Bank House
Broad Street
Spalding, PE11 1TB
Tel: 01775 729252

Cloud 98e51

Job Ref : 26-232
Sheet : R/6
Made by : MAS
Date : 10 June 2026 / Ver. 2023.09.15
Checked :
Approved :

**Nodal Deflections Serviceability (001 : Dead plus Live (Serviceability))**

| Node | Nodal Def. (mm and Degrees) | | | | Node | Nodal Def. (mm and Degrees) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | δ X → | δ Y ↑ | ΦZ ↗ | δ XY | | δ X → | δ Y ↑ | ΦZ ↗ | δ XY |
| 1 | 0.00 | 0.00 | 0.50 | 0.00 | 2 | 0.02 | 0.00 | -1.24 | 0.02 |
| 3 | 120.29 | 0.00 | -0.50 | 120.29 | 4 | 120.27 | 0.00 | 1.24 | 120.27 |
| 5 | 60.15 | -80.19 | 3.07 | 100.24 | | | | | |

**Nodal Deflections Serviceability (002 : Live (Serviceability))**

| Node | Nodal Def. (mm and Degrees) | | | | Node | Nodal Def. (mm and Degrees) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | δ X → | δ Y ↑ | ΦZ ↗ | δ XY | | δ X → | δ Y ↑ | ΦZ ↗ | δ XY |
| 1 | 0.00 | 0.00 | 0.24 | 0.00 | 2 | 0.01 | 0.00 | -0.60 | 0.01 |
| 3 | 57.73 | 0.00 | -0.24 | 57.73 | 4 | 57.72 | 0.00 | 0.60 | 57.72 |
| 5 | 28.87 | -38.49 | 1.47 | 48.11 | | | | | |

**Nodal Deflections Serviceability (003 : Dead (Serviceability))**

| Node | Nodal Def. (mm and Degrees) | | | | Node | Nodal Def. (mm and Degrees) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | δ X → | δ Y ↑ | ΦZ ↗ | δ XY | | δ X → | δ Y ↑ | ΦZ ↗ | δ XY |
| 1 | 0.00 | 0.00 | 0.26 | 0.00 | 2 | 0.01 | 0.00 | -0.65 | 0.01 |
| 3 | 62.56 | 0.00 | -0.26 | 62.56 | 4 | 62.55 | 0.00 | 0.65 | 62.55 |
| 5 | 31.28 | -41.71 | 1.59 | 52.13 | | | | | |

**Member Forces (001 : Dead plus Live (Serviceability))**

| Member No. | Node End1 End2 | Axial Force (kN) | Shear Force (kN) | Bending Moment (kN.m) | Maximum Moment (kN.m @ m) | Maximum Deflection (mm @ m) |
|---|---|---|---|---|---|---|
| 1 | 1 | 0.107T | -0.142 | 0.000 | | 6.667 |
| | 2 | 0.539T | -0.718 | -0.775 | | @ 1.098 |
| 2 | 2 | 0.528C | 0.704 | -0.775 | | 8.271 |
| | 5 | 0.000C | 0.000 | 0.000 | | @ 0.814 |
| 3 | 3 | 0.107T | 0.142 | 0.000 | | 6.667 |
| | 4 | 0.539T | 0.718 | 0.775 | | @ 1.098 |
| 4 | 4 | 0.528C | -0.704 | 0.775 | | 8.271 |
| | 5 | 0.000C | 0.000 | 0.000 | | @ 0.814 |

Members ordered by parts of physical members. Member numbers in Italic are part of the preceeding regular member number.

**Member Forces (002 : Live (Serviceability))**

| Member No. | Node End1 End2 | Axial Force (kN) | Shear Force (kN) | Bending Moment (kN.m) | Maximum Moment (kN.m @ m) | Maximum Deflection (mm @ m) |
|---|---|---|---|---|---|---|
| 1 | 1 | 0.051T | -0.068 | 0.000 | | 3.200 |
| | 2 | 0.259T | -0.345 | -0.372 | | @ 1.098 |
| 2 | 2 | 0.253C | 0.338 | -0.372 | | 3.970 |
| | 5 | 0.000C | 0.000 | 0.000 | | @ 0.814 |

**Shields Wilson**
Bank House
Broad Street
Spalding, PE11 1TB
Tel: 01775 729252

Cloud 98e51

Job Ref : 26-232
Sheet : 2/7
Made by : MAS
Date : 10 June 2026 / Ver. 2023.09.15
Checked :
Approved :

**Member Forces (002 : Live (Serviceability))**

| Member No. | Node End1 End2 | Axial Force (kN) | Shear Force (kN) | Bending Moment (kN.m) | Maximum Moment (kN.m @ m) | Maximum Deflection (mm @ m) |
|---|---|---|---|---|---|---|
| 3 | 3 | 0.051T | 0.068 | 0.000 | | 3.200 |
| | 4 | 0.259T | 0.345 | 0.372 | | @ 1.098 |
| 4 | 4 | 0.253C | -0.338 | 0.372 | | 3.970 |
| | 5 | 0.000C | 0.000 | 0.000 | | @ 0.814 |

Members ordered by parts of physical members. Member numbers in Italic are part of the preceeding regular member number.

**Member Forces (003 : Dead (Serviceability))**

| Member No. | Node End1 End2 | Axial Force (kN) | Shear Force (kN) | Bending Moment (kN.m) | Maximum Moment (kN.m @ m) | Maximum Deflection (mm @ m) |
|---|---|---|---|---|---|---|
| 1 | 1 | 0.055T | -0.074 | 0.000 | | 3.467 |
| | 2 | 0.280T | -0.374 | -0.403 | | @ 1.098 |
| 2 | 2 | 0.275C | 0.366 | -0.403 | | 4.302 |
| | 5 | 0.000C | 0.000 | 0.000 | | @ 0.814 |
| 3 | 3 | 0.055T | 0.074 | 0.000 | | 3.467 |
| | 4 | 0.280T | 0.374 | 0.403 | | @ 1.098 |
| 4 | 4 | 0.275C | -0.366 | 0.403 | | 4.302 |
| | 5 | 0.000C | 0.000 | 0.000 | | @ 0.814 |

Members ordered by parts of physical members. Member numbers in Italic are part of the preceeding regular member number.

**Support Reactions Serviceability (001 : Dead plus Live (Serviceability))**

| Node | Support Reactions (kN and kN.m) | | | Node | Support Reactions (kN and kN.m) | | |
|---|---|---|---|---|---|---|---|
| | Rx→ (kN) | Ry↑ (kN) | Mz↗ (kN.m) | | Rx→ (kN) | Ry↑ (kN) | Mz↗ (kN.m) |
| 1 | 0.000 | -0.178 | 0.000 | 2 | 0.000 | 1.778 | 0.000 |
| 3 | 0.000 | -0.178 | 0.000 | 4 | 0.000 | 1.778 | 0.000 |
| Total | 0.000 | 3.200 | 0.000 | | | | |

**Support Reactions Serviceability (002 : Live (Serviceability))**

| Node | Support Reactions (kN and kN.m) | | | Node | Support Reactions (kN and kN.m) | | |
|---|---|---|---|---|---|---|---|
| | Rx→ (kN) | Ry↑ (kN) | Mz↗ (kN.m) | | Rx→ (kN) | Ry↑ (kN) | Mz↗ (kN.m) |
| 1 | 0.000 | -0.085 | 0.000 | 2 | 0.000 | 0.853 | 0.000 |
| 3 | 0.000 | -0.085 | 0.000 | 4 | 0.000 | 0.853 | 0.000 |
| Total | 0.000 | 1.536 | 0.000 | | | | |

**Support Reactions Serviceability (003 : Dead (Serviceability))**

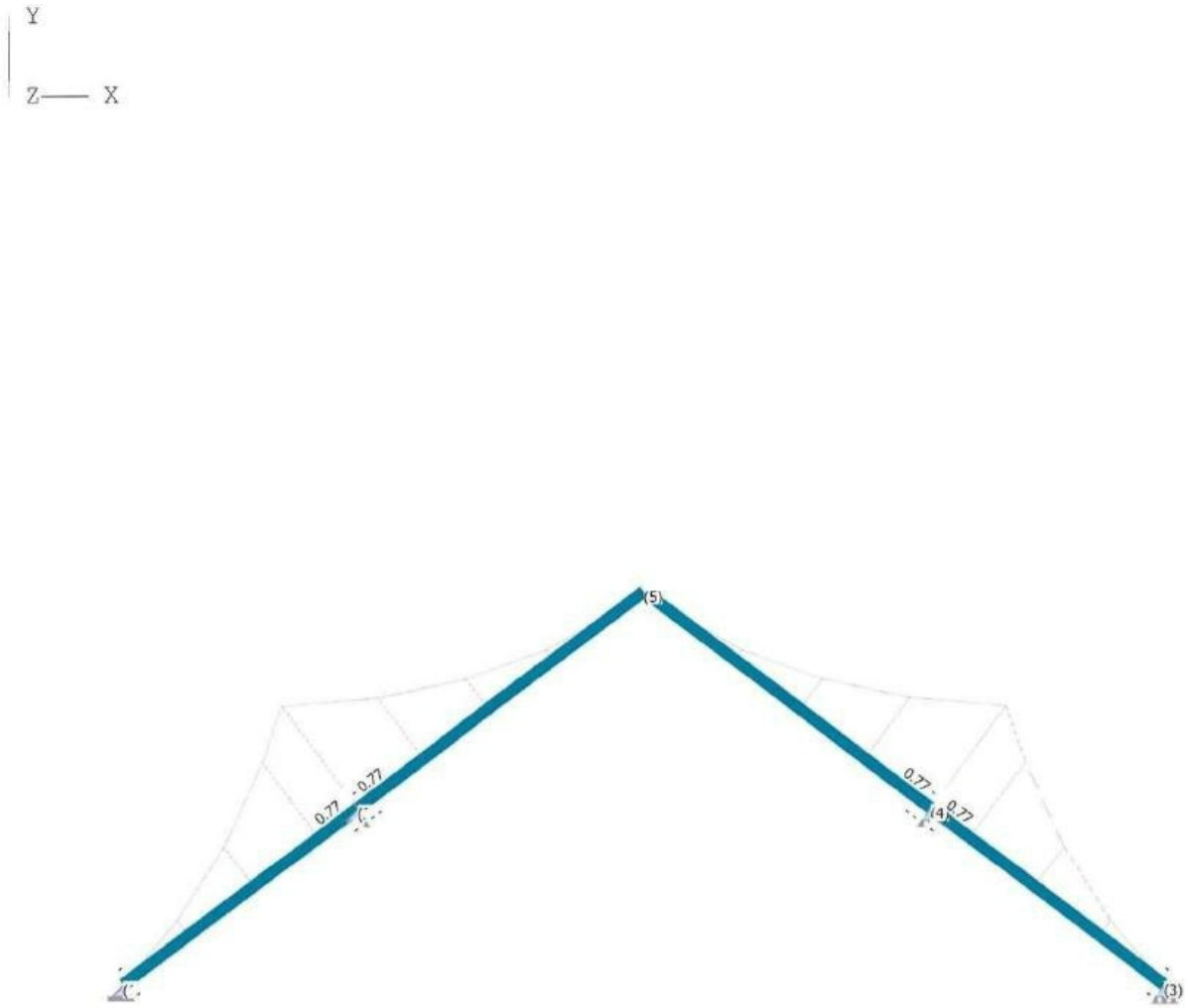
| Node | Support Reactions (kN and kN.m) | | | Node | Support Reactions (kN and kN.m) | | |
|---|---|---|---|---|---|---|---|
| | Rx→ (kN) | Ry↑ (kN) | Mz↗ (kN.m) | | Rx→ (kN) | Ry↑ (kN) | Mz↗ (kN.m) |
| 1 | 0.000 | -0.092 | 0.000 | 2 | 0.000 | 0.925 | 0.000 |
| 3 | 0.000 | -0.092 | 0.000 | 4 | 0.000 | 0.925 | 0.000 |
| Total | 0.000 | 1.664 | 0.000 | | | | |

Software produced by www.MasterSeries.com © Civil and Structural Computer Services Limited.

**Shields Wilson**
Bank House
Broad Street
Spalding, PE11 1TB
Tel: 01775 729252

Cloud 98e51

| | |
|---|---|
| Job Ref | : 26-232 |
| Sheet | : R/8 |
| Made by | : MAS |
| Date | : 10 June 2026 / Ver. 2023.09.15 |
| Checked | : |
| Approved | : |




**Load Case 001 : Dead plus Live (Serviceability)**
**Bending Moment Diagram - (Full Frame) - Front View**

**Not to Scale** **Bending Moment Values (kN.m)** **1 kN.m = 1m**

Software produced by www.MasterSeries.com © Civil and Structural Computer Services Limited.

**Shields Wilson**
Bank House
Broad Street
Spalding, PE11 1TB
Tel: 01775 729252

Cloud 98e51

| | |
|---|---|
| Job Ref | : 26-232 |
| Sheet | : 2/9 |
| Made by | : MAS |
| Date | : 10 June 2026 / Ver. 2023.09.15 |
| Checked | : |
| Approved | : |

# MasterKey : Timber Design
# Axial Load With Moment Design to BS 5268 : Part 2
# Member TBL1Id 1 @ Level 1

## Summary Design Data

| | |
|---|---|
| Design Cases Covered | 1.0 D1 + 1.0 L1, 1.0 L1, 1.0 D1 |
| Deflection Cases Covered | 1.0 D1 + 1.0 L1, 1.0 L1, 1.0 D1 |
| Section Size | b = 47, h = 75, 75x47 in Strength Class C24 |
| Section Properties ($cm^2$,$cm^3$,cm) | Area 35.3, Zx 44.1, Zy 27.6, rx 2.17, ry 1.36 |
| Specification | 2 : Covered and generally unheated, Medium term loading<br>Load sharing |
| Integrated Design Critical Case | : Dead plus Live (Serviceability) |
| Member Details | F = -0.539 kN, L = 1.8 m, Lx = 1.8 m, Ly = 0.3 m, Lex = 1.0 Lx, Ley = 1.0 Ly<br>Bearing length B 75, Distance to Bearing 150 mm |

## Grade and Admissible Stresses (Strength Class C24)

| | | |
|---|---|---|
| $\sigma_{mx.adm} = K_2.K_3.K_{7x}.K_8.\sigma_m$ | 1.00 x 1.25 x 1.16 x 1.10 x 7.50 | 12.01 N/mm² |
| $\sigma_{my.adm} = K_2.K_3.K_{7y}.K_8.\sigma_m$ | 1.00 x 1.25 x 1.17 x 1.10 x 7.50 | 12.07 N/mm² |
| $\sigma_{t.adm} = K_2.K_3.K_8.K_{14}.\sigma_t$ | 1.00 x 1.25 x 1.10 x 1.16 x 4.50 | 7.21 N/mm² |
| $\sigma_{c.adm} = K_2.K_3.K_4.K_8.\sigma_c$ | 1.00 x 1.25 x 1.14 x 1.10 x 1.90 | 2.98 N/mm² |
| $\tau_{adm} = K_2.K_3.K_8.\tau$ | 1.00 x 1.25 x 1.10 x 0.71 | 0.98 N/mm² |
| $E = K_2.E_{mean}$ | 1.00 x 10800 | 10800.0 N/mm² |

## Tensile Resistance

| | | | |
|---|---|---|---|
| $\sigma_{t.a} = F/Area$ | 0.539 / 35.25≤ 7.21 | 0.15 N/mm² | OK |

## Axial Load with Moments Check

| | | | |
|---|---|---|---|
| Critical Design Location | X = 1.800 | | |
| $\sigma_{mx.a} = Mx/Zx$ | 0.775 / 44.06≤ 12.01 | 17.59 N/mm² | **Warning** |
| $\sigma_t/\sigma_{t.adm}+\sigma_{mx}/\sigma_{mx.adm}$ | 0.15/7.21+17.59/12.01 | 1.486 | **Warning** |

## Shear and Bearing Check

| | | | |
|---|---|---|---|
| Critical Design Location | X = 1.800 | | |
| $\tau_a = 1.5\ Fv / Area$ | 1.5 x 0.718 / 35.25≤ 0.98 | 0.31 N/mm² | OK |
| $\sigma_{cax} = Fvx / (b.Bx)$ | 0.718 / (47 x 75)≤ 2.98 | 0.20 N/mm² | OK |

## Deflection Check (Shear Deflection NOT Included)

Critical Load Case 001 : Dead plus Live (Serviceability)

| | | | |
|---|---|---|---|
| $\delta = \delta_m$ | In-span 6.67≤ L/333 | 6.67 mm | **Warning** |

**Shields Wilson**
Bank House
Broad Street
Spalding, PE11 1TB
Tel: 01775 729252

Cloud 98e51

Job Ref : 26-232
Sheet : R/10
Made by : MAS
Date : 10 June 2026 / Ver. 2023.09.15
Checked :
Approved :

# MasterKey : Timber Design
# Axial Load With Moment Design to BS 5268 : Part 2
# Member TBL1Id 2 @ Level 1

## Summary Design Data

| | |
|---|---|
| Design Cases Covered | 1.0 DI + 1.0 LI, 1.0 LI, 1.0 DI |
| Deflection Cases Covered | 1.0 DI + 1.0 LI, 1.0 LI, 1.0 DI |
| Section Size | b = 47, h = 75, 75x47 in Strength Class C24 |
| Section Properties (cm²,cm³,cm) | Area 35.3, Zx 44.1, Zy 27.6, rx 2.17, ry 1.36 |
| Specification | 2 : Covered and generally unheated, Medium term loading<br>Load sharing |
| Integrated Design Critical Case | : Dead plus Live (Serviceability) |
| Member Details | F = 0.528 kN, L = 2.2 m, Lx = 2.2 m, Ly = 0.3 m, Lex = 1.0 Lx, Ley = 1.0 Ly<br>Bearing length B 75, Distance to Bearing 150 mm |

## Grade and Admissible Stresses (Strength Class C24)

| | | |
|---|---|---|
| $\sigma_{mx.adm} = K_2.K_3.K_{7x}.K_8.\sigma_m$ | 1.00 x 1.25 x 1.16 x 1.10 x 7.50 | 12.01 N/mm² |
| $\sigma_{my.adm} = K_2.K_3.K_{7y}.K_8.\sigma_m$ | 1.00 x 1.25 x 1.17 x 1.10 x 7.50 | 12.07 N/mm² |
| $\sigma_{c.adm} = K_2.K_3.K_8.\sigma_c$ | 1.00 x 1.25 x 1.10 x 7.90 | 10.86 N/mm² |
| $\sigma_{c.adm} = K_2.K_3.K_4.K_8.\sigma_c$ | 1.00 x 1.25 x 1.14 x 1.10 x 1.90 | 2.98 N/mm² |
| $\tau_{adm} = K_2.K_3.K_8.\tau$ | 1.00 x 1.25 x 1.10 x 0.71 | 0.98 N/mm² |
| $E = K_2.K_{20}.E_{mean}$(Compression) | 1.00 x 1.00 x 10800 | 7200.0 N/mm² |
| $E = K_2.E_{mean}$(Deflection) | 1.00 x 10800 | 10800.0 N/mm² |

## Compression Resistance

| | | | |
|---|---|---|---|
| $\lambda$ = Max( Lex/rx, Ley/ry) | Max(220/2.165, 30/1.357)≤ 180 | 101.6 | OK |
| $K_{12}$= fn($\lambda$ , $K_3.\sigma_c$, E) | 101.61, 9.88, 7200 | 0.342 | |
| $\sigma_{c.adm} = K_{12}.\sigma_{c.adm}$ | 0.342 x 10.86 | 3.71 N/mm² | |
| $\sigma_{c.a}$ = F/Area | 0.528 / 35.3≤ 3.71 | 0.15 N/mm² | OK |

## Axial Load with Moments Check

| | | | |
|---|---|---|---|
| Critical Design Location | X = 0.000 | | |
| $\sigma_{mx.a}$ = Mx/Zx | 0.775 / 44.06≤ 12.01 | 17.59 N/mm² | **Warning** |
| $\sigma_{mx.adm}=\sigma_{mx.adm}(1-1.5\ K_{12}.\sigma_{c.a}/\sigma_e)$ | 12.01 (1-1.5x0.342x0.15/6.88) | 11.88 N/mm² | |
| $\sigma_c/\sigma_{c.adm}+\sigma_{mx}/\sigma_{mx.adm}$ | 0.15/3.71+17.59/11.88 | 1.521 | **Warning** |

## Shear and Bearing Check

| | | | |
|---|---|---|---|
| Critical Design Location | X = 0.000 | | |
| $\tau_a$= 1.5 Fv / Area | 1.5 x 0.704 / 35.25≤ 0.98 | 0.30 N/mm² | OK |
| $\sigma_{cax}$ = Fvx / (b.Bx) | 0.704 / (47 x 75)≤ 2.98 | 0.20 N/mm² | OK |

## Deflection Check (Shear Deflection NOT Included)

Critical Load Case 001 : Dead plus Live (Serviceability)

| | | | |
|---|---|---|---|
| $\delta = \delta_m$ | In-span 8.27≤ L/333 | 8.27 mm | **Warning** |

**Shields Wilson**
Bank House
Broad Street
Spalding, PE11 1TB
Tel: 01775 729252

Cloud 98e51

Job Ref : 26-232
Sheet : 2/11
Made by : MAS
Date : 10 June 2026 / Ver. 2023.09.15
Checked :
Approved :

# MasterKey : Timber Design
# Axial Load With Moment Design to BS 5268 : Part 2
# Member TBL1Id 3 @ Level 1

## Summary Design Data

| | |
|---|---|
| Design Cases Covered | 1.0 D1 + 1.0 L1, 1.0 L1, 1.0 D1 |
| Deflection Cases Covered | 1.0 D1 + 1.0 L1, 1.0 L1, 1.0 D1 |
| Section Size | b = 47, h = 75, 75x47 in Strength Class C24 |
| Section Properties (cm²,cm³,cm) | Area 35.3, Zx 44.1, Zy 27.6, rx 2.17, ry 1.36 |
| Specification | 2 : Covered and generally unheated, Medium term loading<br>Load sharing |
| Integrated Design Critical Case | : Dead plus Live (Serviceability) |
| Member Details | F = -0.539 kN, L = 1.8 m, Lx = 1.8 m, Ly = 0.3 m, Lex = 1.0 Lx, Ley = 1.0 Ly<br>Bearing length B 75, Distance to Bearing 150 mm |

## Grade and Admissible Stresses (Strength Class C24)

| | | |
|---|---|---|
| $\sigma_{mx.adm} = K_2.K_3.K_{7x}.K_8.\sigma_m$ | 1.00 x 1.25 x 1.16 x 1.10 x 7.50 | 12.01 N/mm² |
| $\sigma_{my.adm} = K_2.K_3.K_{7y}.K_8.\sigma_m$ | 1.00 x 1.25 x 1.17 x 1.10 x 7.50 | 12.07 N/mm² |
| $\sigma_{t.adm} = K_2.K_3.K_8.K_{14}.\sigma_t$ | 1.00 x 1.25 x 1.10 x 1.16 x 4.50 | 7.21 N/mm² |
| $\sigma_{c.adm} = K_2.K_3.K_4.K_8.\sigma_c$ | 1.00 x 1.25 x 1.14 x 1.10 x 1.90 | 2.98 N/mm² |
| $\tau_{adm} = K_2.K_3.K_8.\tau$ | 1.00 x 1.25 x 1.10 x 0.71 | 0.98 N/mm² |
| $E = K_2.E_{mean}$ | 1.00 x 10800 | 10800.0 N/mm² |

## Tensile Resistance

| | | | |
|---|---|---|---|
| $\sigma_{t.a} = F/Area$ | 0.539 / 35.25≤ 7.21 | 0.15 N/mm² | OK |

## Axial Load with Moments Check

| | | | |
|---|---|---|---|
| Critical Design Location | X = 1.800 | | |
| $\sigma_{mx.a} = Mx/Zx$ | 0.775 / 44.06≤ 12.01 | 17.59 N/mm² | **Warning** |
| $\sigma_t/\sigma_{t.adm}+\sigma_{mx}/\sigma_{mx.adm}$ | 0.15/7.21+17.59/12.01 | 1.486 | **Warning** |

## Shear and Bearing Check

| | | | |
|---|---|---|---|
| Critical Design Location | X = 1.800 | | |
| $\tau_a = 1.5\ Fv / Area$ | 1.5 x 0.718 / 35.25≤ 0.98 | 0.31 N/mm² | OK |
| $\sigma_{cax} = Fvx / (b.Bx)$ | 0.718 / (47 x 75)≤ 2.98 | 0.20 N/mm² | OK |

## Deflection Check (Shear Deflection NOT Included)

Critical Load Case 001 : Dead plus Live (Serviceability)

| | | | |
|---|---|---|---|
| $\delta = \delta_m$ | In-span 6.67≤ L/333 | 6.67 mm | **Warning** |

**Shields Wilson**
Bank House
Broad Street
Spalding, PE11 1TB
Tel: 01775 729252

Cloud 98e51

Job Ref : 26-232
Sheet : 2/12
Made by : MAS
Date : 10 June 2026 / Ver. 2023.09.15
Checked :
Approved :

# MasterKey : Timber Design
# Axial Load With Moment Design to BS 5268 : Part 2
# Member TBL1Id 4 @ Level 1

## Summary Design Data

| | |
|---|---|
| Design Cases Covered | 1.0 D1 + 1.0 L1, 1.0 L1, 1.0 D1 |
| Deflection Cases Covered | 1.0 D1 + 1.0 L1, 1.0 L1, 1.0 D1 |
| Section Size | b = 47, h = 75, 75x47 in Strength Class C24 |
| Section Properties (cm²,cm³,cm) | Area 35.3, Zx 44.1, Zy 27.6, rx 2.17, ry 1.36 |
| Specification | 2 : Covered and generally unheated, Medium term loading<br>Load sharing |
| Integrated Design Critical Case | : Dead plus Live (Serviceability) |
| Member Details | F = 0.528 kN, L = 2.2 m, Lx = 2.2 m, Ly = 0.3 m, Lex = 1.0 Lx, Ley = 1.0 Ly<br>Bearing length B 75, Distance to Bearing 150 mm |

## Grade and Admissible Stresses (Strength Class C24)

| | | |
|---|---|---|
| $\sigma_{mx.adm} = K_2.K_3.K_{7x}.K_8.\sigma_m$ | 1.00 x 1.25 x 1.16 x 1.10 x 7.50 | 12.01 N/mm² |
| $\sigma_{my.adm} = K_2.K_3.K_{7y}.K_8.\sigma_m$ | 1.00 x 1.25 x 1.17 x 1.10 x 7.50 | 12.07 N/mm² |
| $\sigma_{c.adm} = K_2.K_3.K_8.\sigma_c$ | 1.00 x 1.25 x 1.10 x 7.90 | 10.86 N/mm² |
| $\sigma_{c.adm} = K_2.K_3.K_4.K_8.\sigma_c$ | 1.00 x 1.25 x 1.14 x 1.10 x 1.90 | 2.98 N/mm² |
| $\tau_{adm} = K_2.K_3.K_8.\tau$ | 1.00 x 1.25 x 1.10 x 0.71 | 0.98 N/mm² |
| $E = K_2.K_{20}.E_{mean}$(Compression) | 1.00 x 1.00 x 10800 | 7200.0 N/mm² |
| $E = K_2.E_{mean}$(Deflection) | 1.00 x 10800 | 10800.0 N/mm² |

## Compression Resistance

| | | | |
|---|---|---|---|
| $\lambda$ = Max( Lex/rx, Ley/ry) | Max(220/2.165, 30/1.357)≤ 180 | 101.6 | OK |
| $K_{12}$= fn($\lambda$ , $K_3.\sigma_c$, E) | 101.61, 9.88, 7200 | 0.342 | |
| $\sigma_{c.adm} = K_{12}.\sigma_{c.adm}$ | 0.342 x 10.86 | 3.71 N/mm² | |
| $\sigma_{c.a}$ = F/Area | 0.528 / 35.3≤ 3.71 | 0.15 N/mm² | OK |

## Axial Load with Moments Check

| | | | |
|---|---|---|---|
| Critical Design Location | X = 0.000 | | |
| $\sigma_{mx.a}$ = Mx/Zx | 0.775 / 44.06≤ 12.01 | 17.59 N/mm² | **Warning** |
| $\sigma_{mx.adm}=\sigma_{mx.adm}(1-1.5\ K_{12}.\sigma_{c.a}/\sigma_e)$ | 12.01 (1-1.5x0.342x0.15/6.88) | 11.88 N/mm² | |
| $\sigma_c/\sigma_{c.adm}+\sigma_{mx}/\sigma_{mx.adm}$ | 0.15/3.71+17.59/11.88 | 1.521 | **Warning** |

## Shear and Bearing Check

| | | | |
|---|---|---|---|
| Critical Design Location | X = 0.000 | | |
| $\tau_a$= 1.5 Fv / Area | 1.5 x 0.704 / 35.25≤ 0.98 | 0.30 N/mm² | OK |
| $\sigma_{cax}$ = Fvx / (b.Bx) | 0.704 / (47 x 75)≤ 2.98 | 0.20 N/mm² | OK |

## Deflection Check (Shear Deflection NOT Included)

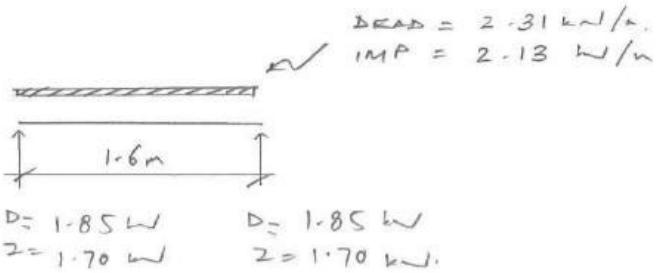
Critical Load Case 001 : Dead plus Live (Serviceability)

| | | | |
|---|---|---|---|
| $\delta = \delta_m$ | In-span 8.27≤ L/333 | 8.27 mm | **Warning** |

SHIELDS WILSON
e: info@shieldswilson.co.uk t: 01775 729252
STRUCTURAL AND CIVIL ENGINEERING

| Structural Calculations | Project: | Date: JUNE '26 | Designer: MLS |
|---|---|---|---|
| Project No: 26-232 | Subject: | Sheet No: 12/13 | Rev: |

DESIGN CHECK 80 x 80 PURLINS




$$\text{MOMENT} = \frac{4.44 \times 1.6^2}{8} = 1.42 \text{ kNm}$$

CHECK 80 x 80 TIMBER PURLIN. $Z = \frac{80 \times 80^2}{6}$

$= 85333 \text{ mm}^3$

$$\therefore \text{STRESS} = \frac{1.42 \times 10^6}{85333} = 16.64 \text{ N/mm}^2$$

$$k7 = \left(\frac{300}{80}\right)^{0.11} = 1.156 \qquad k3 = 1.25$$

$\therefore$ ALLOWABLE STRESS = $1.156 \times 1.25 \times 7.5 = 10.84 \text{ N/mm}^2$

$10.84 \text{ N/m}^2 < 16.64 \text{ N/mm}^2$

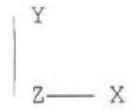
$\therefore$ EXISTING 80 x 80 TIMBER PURLIN IS OVERSTRESSED !

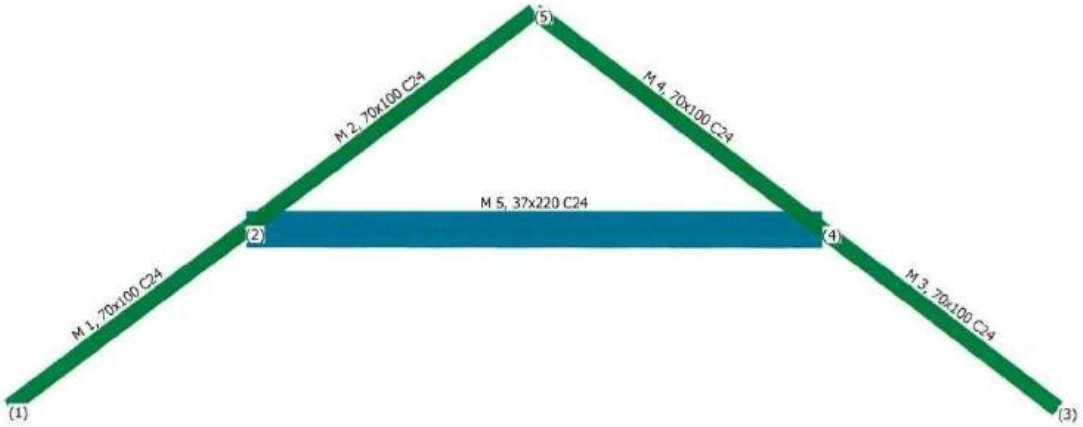
Copyright Shields Wilson Limited.

**Shields Wilson**
**Bank House**
**Broad Street**
**Spalding, PE11 1TB**
**Tel: 01775 729252**

Cloud 98e51

| | |
|---|---|
| **Job Ref** | **: 26-232** |
| **Sheet** | **: 2/14** |
| **Made by** | **: MAS** |
| **Date** | **: 10 June 2026 / Ver. 2023.09.15** |
| **Checked** | **:** |
| **Approved** | **:** |




**Frame Geometry - (Full Frame) - Front View**

**Not to Scale**

**Shields Wilson**
**Bank House**
**Broad Street**
**Spalding, PE11 1TB**
**Tel: 01775 729252**

Cloud 98e51

**Job Ref** : **26-232**
**Sheet** : R/15.
**Made by** : **MAS**
**Date** : **10 June 2026 / Ver. 2023.09.15**
**Checked** :
**Approved** :

# MasterFrame Data File
# Loading Cases and Load Combination

## Load Group Labels

| | |
|---|---|
| Load Group UT | Unity Load Factor (All Cases) |
| Load Group D1 | Dead Load |
| Load Group L1 | Live Load |

## Load Case 001 : Dead plus Live (Serviceability)

| | |
|---|---|
| Load Combination | + 1.00 UT + 1.00 D1 + 1.00 L1 |
| Load Duration | Medium Term |

## Load Case 002 : Live (Serviceability)

| | |
|---|---|
| Load Combination | + 1.00 UT + 1.00 L1 |
| Load Duration | Medium Term |

## Load Case 003 : Dead (Serviceability)

| | |
|---|---|
| Load Combination | + 1.00 UT + 1.00 D1 |
| Load Duration | Long Term |

## The Nodal Co-ordinates

| Node | X (m) | Y (m) | Z (m) | Node | X (m) | Y (m) | Z (m) |
|---|---|---|---|---|---|---|---|
| 1 | 0.000 | 0.000 | 0.000 | 2 | 1.440 | 1.080 | 0.000 |
| 3 | 6.400 | 0.000 | 0.000 | 4 | 4.960 | 1.080 | 0.000 |
| 5 | 3.200 | 2.400 | 0.000 | | | | |

## Member Properties

Members 1-4

```
M  ...  ...        70x100 C24 E 10.80E6 G .675E6 TG C24  3021000
 A 70.0E-4          Ix 583.3E-8         Iy 285.8E-8         J 1143E-8
```

Member 5

```
M  ...  ...        37x220 C24 E 10.80E6 G .675E6 TG C24  3021000
 A 81.4E-4          Ix 3283E-8          Iy 92.86E-8         J 371.5E-8
```

## Member Loading

Member Self Weight Density Load Included in Load Group D1, defined by Modulus of Elasticity

| E kN/mm² | Density kN/m³ |
|---|---|
| >= 200.00 | 77.01 |
| >= 20.00 | 24.00 |
| >= 2.00 | 10.00 |

Members 1-4

```
D1 UDLY -000.216          ( kN/m )
L1 UDLY -000.240          ( kN/m )
```

Members 1-5 - MasterFrame Pro Loads

```
D1 D      010.000         ( kN/m³)
```

## Member End Releases

Symbols End 1 torsion-minor-major End 2 torsion-minor-major O Released ® Fixed

```
2 ®®® ®OO        5 ®OO ®OO
```

**Shields Wilson**
**Bank House**
**Broad Street**
**Spalding, PE11 1TB**
**Tel: 01775 729252**

Cloud 98e51

**Job Ref** : **26-232**
**Sheet** : R/16
**Made by** : **MAS**
**Date** : **10 June 2026 / Ver. 2023.09.15**
**Checked** :
**Approved** :

# Nodal Loading and Support Conditions

NODES 2 & 4
D1 Ls +0000.000 -0003.700 +0000.000 +0000.000 +0000.000 +0000.000
NODES 2 & 4
L1 Ls +0000.000 -0003.400 +0000.000 +0000.000 +0000.000 +0000.000
NODE 1
UT Rs 1 1 1 0 0 0 (Pinned)
NODE 3
UT Rs 0 1 0 0 0 0 (Vertical Restraint)

**Shields Wilson**
Bank House
Broad Street
Spalding, PE11 1TB
Tel: 01775 729252

Cloud 98e51

Job Ref : 26-232
Sheet : 2/17
Made by : MAS
Date : 10 June 2026 / Ver. 2023.09.15
Checked :
Approved :

**Nodal Deflections Serviceability (001 : Dead plus Live (Serviceability))**

| Node | Nodal Def. (mm and Degrees) | | | | Node | Nodal Def. (mm and Degrees) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | δ X → | δ Y ↑ | ΦZ ↗ | δ XY | | δ X → | δ Y ↑ | ΦZ ↗ | δ XY |
| 1 | 0.00 | 0.00 | -18.69 | 0.00 | 2 | 287.10 | -383.01 | -8.41 | 478.67 |
| 3 | 574.61 | 0.00 | 18.69 | 574.61 | 4 | 287.51 | -383.02 | 8.41 | 478.92 |
| 5 | 287.31 | -383.68 | -4.25 | 479.33 | | | | | |

**Nodal Deflections Serviceability (002 : Live (Serviceability))**

| Node | Nodal Def. (mm and Degrees) | | | | Node | Nodal Def. (mm and Degrees) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | δ X → | δ Y ↑ | ΦZ ↗ | δ XY | | δ X → | δ Y ↑ | ΦZ ↗ | δ XY |
| 1 | 0.00 | 0.00 | -8.68 | 0.00 | 2 | 133.42 | -177.99 | -3.91 | 222.44 |
| 3 | 267.02 | 0.00 | 8.68 | 267.02 | 4 | 133.60 | -177.99 | 3.91 | 222.55 |
| 5 | 133.51 | -178.30 | -1.97 | 222.74 | | | | | |

**Nodal Deflections Serviceability (003 : Dead (Serviceability))**

| Node | Nodal Def. (mm and Degrees) | | | | Node | Nodal Def. (mm and Degrees) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | δ X → | δ Y ↑ | ΦZ ↗ | δ XY | | δ X → | δ Y ↑ | ΦZ ↗ | δ XY |
| 1 | 0.00 | 0.00 | -10.00 | 0.00 | 2 | 153.69 | -205.03 | -4.50 | 256.23 |
| 3 | 307.59 | 0.00 | 10.01 | 307.59 | 4 | 153.90 | -205.03 | 4.50 | 256.36 |
| 5 | 153.80 | -205.39 | -2.28 | 256.59 | | | | | |

**Member Forces (001 : Dead plus Live (Serviceability))**

| Member No. | Node End1 End2 | Axial Force (kN) | Shear Force (kN) | Bending Moment (kN.m) | Maximum Moment (kN.m @ m) | Maximum Deflection (mm @ m) |
|---|---|---|---|---|---|---|
| 1 | 1 | 5.390C | 7.186 | 0.000 | | 41.547 |
| | 2 | 4.920C | 6.560 | 12.372 | | @ 1.044 |
| 2 | 2 | 8.582C | -5.241 | 12.372 | | 62.603 |
| | 5 | 8.008C | -6.006 | 0.000 | | @ 0.924 |
| 3 | 3 | 5.389C | -7.187 | 0.000 | | 41.548 |
| | 4 | 4.920C | -6.560 | -12.372 | | @ 1.044 |
| 4 | 4 | 8.582C | 5.241 | -12.372 | | 62.605 |
| | 5 | 8.008C | 6.006 | 0.000 | | @ 0.924 |
| 5 | 2 | 10.010T | 0.143 | 0.000 | 0.126 | 0.459 |
| | 4 | 10.010T | -0.143 | 0.000 | @ 1.654 | @ 1.760 |

Members ordered by parts of physical members. Member numbers in Italic are part of the preceeding regular member number.

**Member Forces (002 : Live (Serviceability))**

| Member No. | Node End1 End2 | Axial Force (kN) | Shear Force (kN) | Bending Moment (kN.m) | Maximum Moment (kN.m @ m) | Maximum Deflection (mm @ m) |
|---|---|---|---|---|---|---|
| 1 | 1 | 2.501C | 3.335 | 0.000 | | 19.304 |
| | 2 | 2.294C | 3.058 | 5.753 | | @ 1.044 |

Software produced by www.MasterSeries.com © Civil and Structural Computer Services Limited.

**Shields Wilson**
Bank House
Broad Street
Spalding, PE11 1TB
Tel: 01775 729252

Cloud 98e51

Job Ref : 26-232
Sheet : R/18
Made by : MAS
Date : 10 June 2026 / Ver. 2023.09.15
Checked :
Approved :

**Member Forces (002 : Live (Serviceability))**

| Member No. | Node End1 End2 | Axial Force (kN) | Shear Force (kN) | Bending Moment (kN.m) | Maximum Moment (kN.m @ m) | Maximum Deflection (mm @ m) |
|---|---|---|---|---|---|---|
| 2 | 2 | 3.966C | -2.446 | 5.753 | | 29.074 |
| | 5 | 3.712C | -2.784 | 0.000 | | @ 0.924 |
| 3 | 3 | 2.501C | -3.335 | 0.000 | | 19.304 |
| | 4 | 2.293C | -3.058 | -5.754 | | @ 1.044 |
| 4 | 4 | 3.966C | 2.446 | -5.754 | | 29.075 |
| | 5 | 3.712C | 2.784 | 0.000 | | @ 0.924 |
| 5 | 2 | 4.640T | 0.000 | 0.000 | 0.000 | 0.000 |
| | 4 | 4.640T | 0.000 | 0.000 | @ 0.000 | @ 0.000 |

Members ordered by parts of physical members. Member numbers in Italic are part of the preceeding regular member number.

**Member Forces (003 : Dead (Serviceability))**

| Member No. | Node End1 End2 | Axial Force (kN) | Shear Force (kN) | Bending Moment (kN.m) | Maximum Moment (kN.m @ m) | Maximum Deflection (mm @ m) |
|---|---|---|---|---|---|---|
| 1 | 1 | 2.889C | 3.852 | 0.000 | | 22.243 |
| | 2 | 2.627C | 3.502 | 6.618 | | @ 1.044 |
| 2 | 2 | 4.617C | -2.795 | 6.618 | | 33.529 |
| | 5 | 4.296C | -3.222 | 0.000 | | @ 0.924 |
| 3 | 3 | 2.889C | -3.852 | 0.000 | | 22.244 |
| | 4 | 2.626C | -3.502 | -6.619 | | @ 1.044 |
| 4 | 4 | 4.617C | 2.795 | -6.619 | | 33.530 |
| | 5 | 4.296C | 3.222 | 0.000 | | @ 0.924 |
| 5 | 2 | 5.370T | 0.143 | 0.000 | 0.126 | 0.459 |
| | 4 | 5.370T | -0.143 | 0.000 | @ 1.654 | @ 1.760 |

Members ordered by parts of physical members. Member numbers in Italic are part of the preceeding regular member number.

**Support Reactions Serviceability (001 : Dead plus Live (Serviceability))**

| Node | Support Reactions (kN and kN.m) | | | Node | Support Reactions (kN and kN.m) | | |
|---|---|---|---|---|---|---|---|
| | Rx→ (kN) | Ry↑ (kN) | Mz↗ (kN.m) | | Rx→ (kN) | Ry↑ (kN) | Mz↗ (kN.m) |
| 1 | 0.000 | 8.983 | 0.000 | 3 | 0.000 | 8.983 | 0.000 |
| Total | 0.000 | 17.966 | 0.000 | | | | |

**Support Reactions Serviceability (002 : Live (Serviceability))**

| Node | Support Reactions (kN and kN.m) | | | Node | Support Reactions (kN and kN.m) | | |
|---|---|---|---|---|---|---|---|
| | Rx→ (kN) | Ry↑ (kN) | Mz↗ (kN.m) | | Rx→ (kN) | Ry↑ (kN) | Mz↗ (kN.m) |
| 1 | 0.000 | 4.168 | 0.000 | 3 | 0.000 | 4.168 | 0.000 |
| Total | 0.000 | 8.336 | 0.000 | | | | |

**Shields Wilson**
**Bank House**
**Broad Street**
**Spalding, PE11 1TB**
**Tel: 01775 729252**

Cloud 98e51

**Job Ref** : 26-232
**Sheet** : R/19
**Made by** : MAS
**Date** : 10 June 2026 / Ver. 2023.09.15
**Checked** :
**Approved** :

**Support Reactions Serviceability (003 : Dead (Serviceability))**

| Node | Support Reactions (kN and kN.m) | | | Node | Support Reactions (kN and kN.m) | | |
|---|---|---|---|---|---|---|---|
| | Rx→ (kN) | Ry↑ (kN) | Mz↗ (kN.m) | | Rx→ (kN) | Ry↑ (kN) | Mz↗ (kN.m) |
| 1 | 0.000 | 4.815 | 0.000 | 3 | 0.000 | 4.815 | 0.000 |
| Total | 0.000 | 9.629 | 0.000 | | | | |

**Shields Wilson**
Bank House
Broad Street
Spalding, PE11 1TB
Tel: 01775 729252

Cloud 98e51

| | |
|---|---|
| Job Ref | : 26-232 |
| Sheet | : R/20. |
| Made by | : MAS |
| Date | : 10 June 2026 / Ver. 2023.09.15 |
| Checked | : |
| Approved | : |

# MasterKey : Timber Design
# Axial Load With Moment Design to BS 5268 : Part 2
# Member TBL1Id 1 @ Level 1

## Summary Design Data

| | |
|---|---|
| Design Cases Covered | 1.0 D1 + 1.0 L1, 1.0 L1, 1.0 D1 |
| Deflection Cases Covered | 1.0 D1 + 1.0 L1, 1.0 L1, 1.0 D1 |
| Section Size | b = 70, h = 100, 100x70 in Strength Class C24 |
| Section Properties ($cm^2$,$cm^3$,cm) | Area 70, Zx 116.7, Zy 81.7, rx 2.89, ry 2.02 |
| Specification | 2 : Covered and generally unheated, Medium term loading<br>Load sharing |
| Integrated Design Critical Case | : Dead plus Live (Serviceability) |
| Member Details | F = 5.39 kN, L = 1.8 m, Lx = 1.8 m, Ly = 0.3 m, Lex = 1.0 Lx, Ley = 1.0 Ly<br>Bearing length B 75, Distance to Bearing 150 mm |

## Grade and Admissible Stresses (Strength Class C24)

| | | |
|---|---|---|
| $\sigma_{mx.adm} = K_2.K_3.K_{7x}.K_8.\sigma_m$ | 1.00 x 1.25 x 1.13 x 1.10 x 7.50 | 11.64 N/mm² |
| $\sigma_{my.adm} = K_2.K_3.K_{7v}.K_8.\sigma_m$ | 1.00 x 1.25 x 1.17 x 1.10 x 7.50 | 12.07 N/mm² |
| $\sigma_{c.adm} = K_2.K_3.K_8.\sigma_c$ | 1.00 x 1.25 x 1.10 x 7.90 | 10.86 N/mm² |
| $\sigma_{c.adm} = K_2.K_3.K_4.K_8.\sigma_c$ | 1.00 x 1.25 x 1.14 x 1.10 x 1.90 | 2.98 N/mm² |
| $\tau_{adm} = K_2.K_3.K_8.\tau$ | 1.00 x 1.25 x 1.10 x 0.71 | 0.98 N/mm² |
| $E = K_2.K_{20}.E_{mean}$(Compression) | 1.00 x 1.00 x 10800 | 7200.0 N/mm² |
| $E = K_2.E_{mean}$(Deflection) | 1.00 x 10800 | 10800.0 N/mm² |

## Compression Resistance

| | | | |
|---|---|---|---|
| $\lambda$ = Max( Lex/rx, Ley/ry) | Max(180/2.887, 30/2.021)≤ 180 | 62.4 | OK |
| $K_{12}$= fn($\lambda$ , $K_3.\sigma_c$, E) | 62.35, 9.88, 7200 | 0.616 | |
| $\sigma_{c.adm} = K_{12}.\sigma_{c.adm}$ | 0.616 x 10.86 | 6.69 N/mm² | |
| $\sigma_{c.a}$ = F/Area | 5.39 / 70≤ 6.69 | 0.77 N/mm² | OK |

## Axial Load with Moments Check

| | | | |
|---|---|---|---|
| Critical Design Location | X = 1.800 | | |
| $\sigma_{mx.a}$ = Mx/Zx | 12.372 / 116.67≤ 11.64 | 106.05 N/mm² | **Warning** |
| $\sigma_{mx.adm}=\sigma_{mx.adm}(1\text{-}1.5\ K_{12}.\sigma_{c.a}/\sigma_e)$ | 11.64 (1-1.5x0.616x0.77/18.28) | 11.18 N/mm² | |
| $\sigma_c/\sigma_{c.adm}+\sigma_{mx}/\sigma_{mx.adm}$ | 0.77/6.69+106.05/11.18 | 9.597 | **Warning** |

## Shear and Bearing Check

| | | | |
|---|---|---|---|
| Critical Design Location | X = 0.000 | | |
| $\tau_a$= 1.5 Fv / Area | 1.5 x 7.186 / 70≤ 0.98 | 1.54 N/mm² | **Warning** |
| $\sigma_{cax}$ = Fvx / (b.Bx) | 7.186 / (70 x 75)≤ 2.98 | 1.37 N/mm² | OK |

## Deflection Check (Shear Deflection NOT Included)

Critical Load Case 001 : Dead plus Live (Serviceability)

| | | | |
|---|---|---|---|
| $\delta = \delta_m$ | In-span 41.55≤ L/333 | 41.55 mm | **Warning** |

**Shields Wilson**
Bank House
Broad Street
Spalding, PE11 1TB
Tel: 01775 729252

Cloud 98e51

Job Ref : 26-232
Sheet : 2/21.
Made by : MAS
Date : 10 June 2026 / Ver. 2023.09.15
Checked :
Approved :

# MasterKey : Timber Design
# Axial Load With Moment Design to BS 5268 : Part 2
# Member TBL1Id 2 @ Level 1

## Summary Design Data

| | |
|---|---|
| Design Cases Covered | 1.0 D1 + 1.0 L1, 1.0 L1, 1.0 D1 |
| Deflection Cases Covered | 1.0 D1 + 1.0 L1, 1.0 L1, 1.0 D1 |
| Section Size | b = 70, h = 100, 100x70 in Strength Class C24 |
| Section Properties (cm²,cm³,cm) | Area 70, Zx 116.7, Zy 81.7, rx 2.89, ry 2.02 |
| Specification | 2 : Covered and generally unheated, Medium term loading<br>Load sharing |
| Integrated Design Critical Case | : Dead plus Live (Serviceability) |
| Member Details | F = 8.582 kN, L = 2.2 m, Lx = 2.2 m, Ly = 0.3 m, Lex = 1.0 Lx, Ley = 1.0 Ly<br>Bearing length B 75, Distance to Bearing 150 mm |

## Grade and Admissible Stresses (Strength Class C24)

| | | |
|---|---|---|
| $\sigma_{mx.adm} = K_2.K_3.K_{7x}.K_8.\sigma_m$ | 1.00 x 1.25 x 1.13 x 1.10 x 7.50 | 11.64 N/mm² |
| $\sigma_{my.adm} = K_2.K_3.K_{7y}.K_8.\sigma_m$ | 1.00 x 1.25 x 1.17 x 1.10 x 7.50 | 12.07 N/mm² |
| $\sigma_{c.adm} = K_2.K_3.K_8.\sigma_c$ | 1.00 x 1.25 x 1.10 x 7.90 | 10.86 N/mm² |
| $\sigma_{c.adm} = K_2.K_3.K_4.K_8.\sigma_c$ | 1.00 x 1.25 x 1.14 x 1.10 x 1.90 | 2.98 N/mm² |
| $\tau_{adm} = K_2.K_3.K_8.\tau$ | 1.00 x 1.25 x 1.10 x 0.71 | 0.98 N/mm² |
| $E = K_2.K_{20}.E_{mean}$(Compression) | 1.00 x 1.00 x 10800 | 7200.0 N/mm² |
| $E = K_2.E_{mean}$(Deflection) | 1.00 x 10800 | 10800.0 N/mm² |

## Compression Resistance

| | | | |
|---|---|---|---|
| $\lambda$ = Max( Lex/rx, Ley/ry) | Max(220/2.887, 30/2.021)≤ 180 | 76.2 | OK |
| $K_{12} = fn(\lambda, K_3.\sigma_c, E)$ | 76.21, 9.88, 7200 | 0.505 | |
| $\sigma_{c.adm} = K_{12}.\sigma_{c.adm}$ | 0.505 x 10.86 | 5.49 N/mm² | |
| $\sigma_{c.a}$ = F/Area | 8.582 / 70≤ 5.49 | 1.23 N/mm² | OK |

## Axial Load with Moments Check

| | | | |
|---|---|---|---|
| Critical Design Location | X = 0.000 | | |
| $\sigma_{mx.a}$ = Mx/Zx | 12.372 / 116.67≤ 11.64 | 106.05 N/mm² | **Warning** |
| $\sigma_{mx.adm} = \sigma_{mx.adm}(1\text{-}1.5\ K_{12}.\sigma_{c.a}/\sigma_e)$ | 11.64 (1-1.5x0.505x1.23/12.24) | 10.75 N/mm² | |
| $\sigma_c/\sigma_{c.adm} + \sigma_{mx}/\sigma_{mx.adm}$ | 1.23/5.49+106.05/10.75 | 10.085 | **Warning** |

## Shear and Bearing Check

| | | | |
|---|---|---|---|
| Critical Design Location | X = 2.200 | | |
| $\tau_a$= 1.5 Fv / Area | 1.5 x 6.006 / 70≤ 0.98 | 1.29 N/mm² | **Warning** |
| $\sigma_{cax}$ = Fvx / (b.Bx) | 6.006 / (70 x 75)≤ 2.98 | 1.14 N/mm² | OK |

## Deflection Check (Shear Deflection NOT Included)

Critical Load Case 001 : Dead plus Live (Serviceability)

| | | | |
|---|---|---|---|
| $\delta = \delta_m$ | In-span 62.60≤ L/333 | 62.60 mm | **Warning** |

**Shields Wilson**
**Bank House**
**Broad Street**
**Spalding, PE11 1TB**
**Tel: 01775 729252**

Cloud 98e51

**Job Ref** : 26-232
**Sheet** : 2/22
**Made by** : MAS
**Date** : 10 June 2026 / Ver. 2023.09.15
**Checked** :
**Approved** :

# MasterKey : Timber Design
# Axial Load With Moment Design to BS 5268 : Part 2
# Member TBL1Id 3 @ Level 1

## Summary Design Data

| | |
|---|---|
| Design Cases Covered | 1.0 D1 + 1.0 L1, 1.0 L1, 1.0 D1 |
| Deflection Cases Covered | 1.0 D1 + 1.0 L1, 1.0 L1, 1.0 D1 |
| Section Size | b = 70, h = 100, 100x70 in Strength Class C24 |
| Section Properties ($cm^2$,$cm^3$,cm) | Area 70, Zx 116.7, Zy 81.7, rx 2.89, ry 2.02 |
| Specification | 2 : Covered and generally unheated, Medium term loading<br>Load sharing |
| Integrated Design Critical Case | : Dead plus Live (Serviceability) |
| Member Details | F = 5.389 kN, L = 1.8 m, Lx = 1.8 m, Ly = 0.3 m, Lex = 1.0 Lx, Ley = 1.0 Ly<br>Bearing length B 75, Distance to Bearing 150 mm |

## Grade and Admissible Stresses (Strength Class C24)

| | | |
|---|---|---|
| $\sigma_{mx.adm} = K_2.K_3.K_{7x}.K_8.\sigma_m$ | 1.00 x 1.25 x 1.13 x 1.10 x 7.50 | 11.64 N/mm² |
| $\sigma_{my.adm} = K_2.K_3.K_{7y}.K_8.\sigma_m$ | 1.00 x 1.25 x 1.17 x 1.10 x 7.50 | 12.07 N/mm² |
| $\sigma_{c.adm} = K_2.K_3.K_8.\sigma_c$ | 1.00 x 1.25 x 1.10 x 7.90 | 10.86 N/mm² |
| $\sigma_{c.adm} = K_2.K_3.K_4.K_8.\sigma_c$ | 1.00 x 1.25 x 1.14 x 1.10 x 1.90 | 2.98 N/mm² |
| $\tau_{adm} = K_2.K_3.K_8.\tau$ | 1.00 x 1.25 x 1.10 x 0.71 | 0.98 N/mm² |
| $E = K_2.K_{20}.E_{mean}$(Compression) | 1.00 x 1.00 x 10800 | 7200.0 N/mm² |
| $E = K_2.E_{mean}$(Deflection) | 1.00 x 10800 | 10800.0 N/mm² |

## Compression Resistance

| | | | |
|---|---|---|---|
| $\lambda$ = Max( Lex/rx, Ley/ry) | Max(180/2.887, 30/2.021)≤ 180 | 62.4 | OK |
| $K_{12} = fn(\lambda, K_3.\sigma_c, E)$ | 62.35, 9.88, 7200 | 0.616 | |
| $\sigma_{c.adm} = K_{12}.\sigma_{c.adm}$ | 0.616 x 10.86 | 6.69 N/mm² | |
| $\sigma_{c.a}$ = F/Area | 5.389 / 70≤ 6.69 | 0.77 N/mm² | OK |

## Axial Load with Moments Check

| | | | |
|---|---|---|---|
| Critical Design Location | X = 1.800 | | |
| $\sigma_{mx.a}$ = Mx/Zx | 12.372 / 116.67≤ 11.64 | 106.05 N/mm² | **Warning** |
| $\sigma_{mx.adm} = \sigma_{mx.adm}(1\text{-}1.5\ K_{12}.\sigma_{c.a}/\sigma_e)$ | 11.64 (1-1.5x0.616x0.77/18.28) | 11.18 N/mm² | |
| $\sigma_c/\sigma_{c.adm} + \sigma_{mx}/\sigma_{mx.adm}$ | 0.77/6.69+106.05/11.18 | 9.597 | **Warning** |

## Shear and Bearing Check

| | | | |
|---|---|---|---|
| Critical Design Location | X = 0.000 | | |
| $\tau_a$= 1.5 Fv / Area | 1.5 x 7.187 / 70≤ 0.98 | 1.54 N/mm² | **Warning** |
| $\sigma_{cax}$ = Fvx / (b.Bx) | 7.187 / (70 x 75)≤ 2.98 | 1.37 N/mm² | OK |

## Deflection Check (Shear Deflection NOT Included)

Critical Load Case 001 : Dead plus Live (Serviceability)

| | | | |
|---|---|---|---|
| $\delta = \delta_m$ | In-span 41.55≤ L/333 | 41.55 mm | **Warning** |

**Shields Wilson**
Bank House
Broad Street
Spalding, PE11 1TB
Tel: 01775 729252

Cloud 98e51

Job Ref : 26-232
Sheet : 2/23
Made by : MAS
Date : 10 June 2026 / Ver. 2023.09.15
Checked :
Approved :

# MasterKey : Timber Design
# Axial Load With Moment Design to BS 5268 : Part 2
# Member TBL1Id 4 @ Level 1

## Summary Design Data

| | |
|---|---|
| Design Cases Covered | 1.0 D1 + 1.0 L1, 1.0 L1, 1.0 D1 |
| Deflection Cases Covered | 1.0 D1 + 1.0 L1, 1.0 L1, 1.0 D1 |
| Section Size | b = 70, h = 100, 100x70 in Strength Class C24 |
| Section Properties ($cm^2$,$cm^3$,cm) | Area 70, Zx 116.7, Zy 81.7, rx 2.89, ry 2.02 |
| Specification | 2 : Covered and generally unheated, Medium term loading<br>Load sharing |
| Integrated Design Critical Case | : Dead plus Live (Serviceability) |
| Member Details | F = 8.582 kN, L = 2.2 m, Lx = 2.2 m, Ly = 0.3 m, Lex = 1.0 Lx, Ley = 1.0 Ly<br>Bearing length B 75, Distance to Bearing 150 mm |

## Grade and Admissible Stresses (Strength Class C24)

| | | |
|---|---|---|
| $\sigma_{mx.adm} = K_2.K_3.K_{7x}.K_8.\sigma_m$ | 1.00 x 1.25 x 1.13 x 1.10 x 7.50 | 11.64 N/mm² |
| $\sigma_{my.adm} = K_2.K_3.K_{7v}.K_8.\sigma_m$ | 1.00 x 1.25 x 1.17 x 1.10 x 7.50 | 12.07 N/mm² |
| $\sigma_{c.adm} = K_2.K_3.K_8.\sigma_c$ | 1.00 x 1.25 x 1.10 x 7.90 | 10.86 N/mm² |
| $\sigma_{c.adm} = K_2.K_3.K_4.K_8.\sigma_c$ | 1.00 x 1.25 x 1.14 x 1.10 x 1.90 | 2.98 N/mm² |
| $\tau_{adm} = K_2.K_3.K_8.\tau$ | 1.00 x 1.25 x 1.10 x 0.71 | 0.98 N/mm² |
| $E = K_2.K_{20}.E_{mean}$(Compression) | 1.00 x 1.00 x 10800 | 7200.0 N/mm² |
| $E = K_2.E_{mean}$(Deflection) | 1.00 x 10800 | 10800.0 N/mm² |

## Compression Resistance

| | | | |
|---|---|---|---|
| $\lambda$ = Max( Lex/rx, Ley/ry) | Max(220/2.887, 30/2.021)≤ 180 | 76.2 | OK |
| $K_{12}$= fn($\lambda$ , $K_3.\sigma_c$, E) | 76.21, 9.88, 7200 | 0.505 | |
| $\sigma_{c.adm} = K_{12}.\sigma_{c.adm}$ | 0.505 x 10.86 | 5.49 N/mm² | |
| $\sigma_{c.a}$ = F/Area | 8.582 / 70≤ 5.49 | 1.23 N/mm² | OK |

## Axial Load with Moments Check

| | | | |
|---|---|---|---|
| Critical Design Location | X = 0.000 | | |
| $\sigma_{mx.a}$ = Mx/Zx | 12.372 / 116.67≤ 11.64 | 106.05 N/mm² | **Warning** |
| $\sigma_{mx.adm}=\sigma_{mx.adm}(1-1.5\ K_{12}.\sigma_{c.a}/\sigma_e)$ | 11.64 (1-1.5x0.505x1.23/12.24) | 10.75 N/mm² | |
| $\sigma_c/\sigma_{c.adm}+\sigma_{mx}/\sigma_{mx.adm}$ | 1.23/5.49+106.05/10.75 | 10.085 | **Warning** |

## Shear and Bearing Check

| | | | |
|---|---|---|---|
| Critical Design Location | X = 2.200 | | |
| $\tau_a$= 1.5 Fv / Area | 1.5 x 6.006 / 70≤ 0.98 | 1.29 N/mm² | **Warning** |
| $\sigma_{cax}$ = Fvx / (b.Bx) | 6.006 / (70 x 75)≤ 2.98 | 1.14 N/mm² | OK |

## Deflection Check (Shear Deflection NOT Included)

Critical Load Case 001 : Dead plus Live (Serviceability)

| | | | |
|---|---|---|---|
| $\delta = \delta_m$ | In-span 62.60≤ L/333 | 62.60 mm | **Warning** |

**Shields Wilson**
Bank House
Broad Street
Spalding, PE11 1TB
Tel: 01775 729252

Cloud 98e51

Job Ref : 26-232
Sheet : R/24
Made by : MAS
Date : 10 June 2026 / Ver. 2023.09.15
Checked :
Approved :

# MasterKey : Timber Design
# Axial Load With Moment Design to BS 5268 : Part 2
# Member TBL1Id 5 @ Level 1

## Summary Design Data

| | |
|---|---|
| Design Cases Covered | 1.0 D1 + 1.0 L1, 1.0 L1, 1.0 D1 |
| Deflection Cases Covered | 1.0 D1 + 1.0 L1, 1.0 L1, 1.0 D1 |
| Section Size | b = 37, h = 220, 220x37 in Strength Class C24 |
| Section Properties ($cm^2$,$cm^3$,cm) | Area 81.4, Zx 298.5, Zy 50.2, rx 6.35, ry 1.07 |
| Specification | 2 : Covered and generally unheated, Medium Term loading<br>Load sharing |
| Integrated Design Critical Case | : Dead plus Live (Serviceability) |
| Member Details | F = -10.01 kN, L = 3.52 m, Lx = 3.52 m, Ly = 3.52 m, Lex = 1.0 Lx, Ley = 1.0 Ly<br>Bearing length B 75, Distance to Bearing 150 mm |

## Grade and Admissible Stresses (Strength Class C24)

| | | |
|---|---|---|
| $\sigma_{mx.adm} = K_2.K_3.K_{7x}.K_8.\sigma_m$ | 1.00 x 1.25 x 1.03 x 1.10 x 7.50 | 10.67 N/mm² |
| $\sigma_{my.adm} = K_2.K_3.K_{7y}.K_8.\sigma_m$ | 1.00 x 1.25 x 1.17 x 1.10 x 7.50 | 12.07 N/mm² |
| $\sigma_{t.adm} = K_2.K_3.K_8.K_{14}.\sigma_t$ | 1.00 x 1.25 x 1.10 x 1.03 x 4.50 | 6.40 N/mm² |
| $\sigma_{c.adm} = K_2.K_3.K_4.K_8.\sigma_c$ | 1.00 x 1.25 x 1.14 x 1.10 x 1.90 | 2.98 N/mm² |
| $\tau_{adm} = K_2.K_3.K_8.\tau$ | 1.00 x 1.25 x 1.10 x 0.71 | 0.98 N/mm² |
| $E = K_2.K_{20}.E_{mean}$(Compression) | 1.00 x 1.00 x 10800 | 7200.0 N/mm² |
| $E = K_2.E_{mean}$(Deflection) | 1.00 x 10800 | 10800.0 N/mm² |

## Tensile Resistance

| | | | |
|---|---|---|---|
| $\sigma_{t.a} = F/Area$ | 10.01 / 81.4≤ 6.40 | 1.23 N/mm² | OK |

## Axial Load with Moments Check

| | | | |
|---|---|---|---|
| Critical Design Location | X = 1.654 | | |
| $\sigma_{mx.a} = Mx/Zx$ | 0.125 / 298.47≤ 10.67 | 0.42 N/mm² | OK |
| $\sigma_t/\sigma_{t.adm}+\sigma_{mx}/\sigma_{mx.adm}$ | 1.23/6.40+0.42/10.67 | 0.231 | OK |

## Shear and Bearing Check

| | | | |
|---|---|---|---|
| Critical Design Location | X = 0.000 | | |
| $\tau_a = 1.5\ Fv / Area$ | 1.5 x 0.143 / 81.4≤ 0.98 | 0.03 N/mm² | OK |
| $\sigma_{cax} = Fvx / (b.Bx)$ | 0.143 / (37 x 75)≤ 2.98 | 0.05 N/mm² | OK |

## Deflection Check (Shear Deflection NOT Included)

Critical Load Case 001 : Dead plus Live (Serviceability)

| | | | |
|---|---|---|---|
| $\delta = \delta_m$ | In-span 0.46≤ L/333 | 0.46 mm | OK |

# APPENDIX B


© Shields Wilson Limited.

SHIELDS WILSON
e: info@shieldswilson.co.uk t: 01775 729252
STRUCTURAL AND CIVIL ENGINEERING

| Structural Calculations | Project: MAGPIE COTTAGE | Date: JUNE '26 | Designer: MAS |
|---|---|---|---|
| Project No: 26-232 | Subject: | Sheet No: FJ/1 | Rev: |

1ST FLOOR JOISTS 50×150 @ 400 c/c

DEAD LOAD = 0.57 kN/m²
LIVE LOAD = 1.50 kN/m²

LOAD/m = (0.57 + 1.50) × 0.40 = 0.828 kN/m

SPAN = 3.55 m ∴ MOMENT = $\frac{0.828 \times 3.55^2}{8}$ = 1.304 kNm

Z = $\frac{50 \times 150^2}{6}$ = 187500 mm³

∴ STRESS = $\frac{1.304 \times 10^6}{187500}$ = 6.955 N/mm²

K7 = $\left(\frac{300}{150}\right)^{0.11}$ = 1.07 K8 = 1.1

∴ ALLOWABLE STRESS = 5.3 × 1.07 × 1.1 = 6.24 N/mm²

6.24 N/mm² < 6.95 N/mm² ∴ JOIST IS OVER STRESSED!

CHECK DEFLECTION (TOTAL LOAD)

I = $\frac{50 \times 150^3}{12}$ = 14.06 × 10⁶ mm⁴ E = 8800

∴ $\frac{5 \times 0.828 \times 3550^4}{384 \times 8800 \times 14.06 \times 10^6}$ = 13.84 mm

ALLOWABLE DEFLECTION = 0.003 × 3550 = 10.65 mm

∴ ACTUAL DEFLECTION IS GREATER THAN ALLOWABLE

Copyright Shields Wilson Limited.

# APPENDIX C


© Shields Wilson Limited.



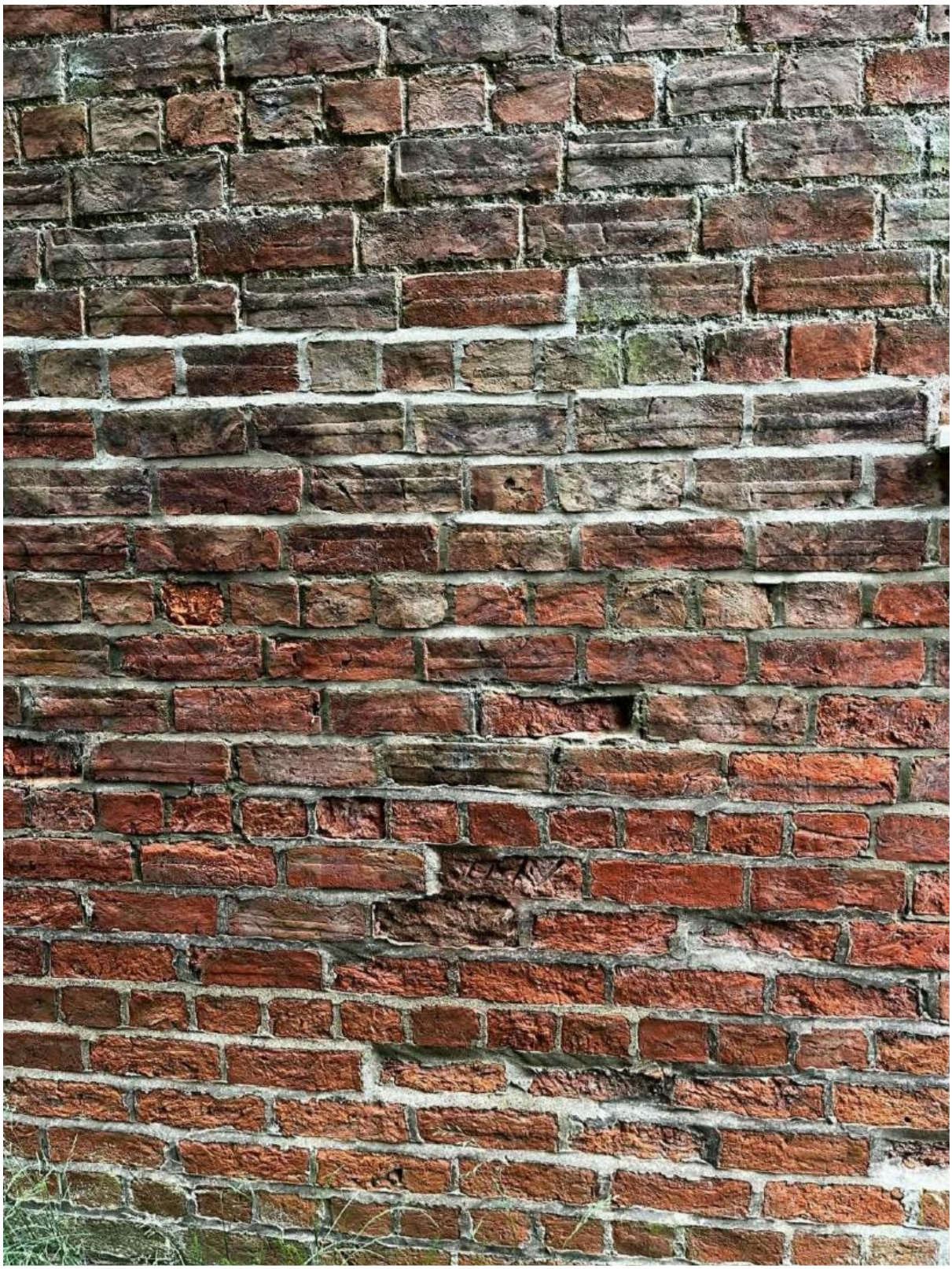



© Shields Wilson Limited.





© Shields Wilson Limited.




© Shields Wilson Limited.






© Shields Wilson Limited.




© Shields Wilson Limited.






© Shields Wilson Limited.




© Shields Wilson Limited.




© Shields Wilson Limited.




© Shields Wilson Limited.






© Shields Wilson Limited.




© Shields Wilson Limited.




© Shields Wilson Limited.




© Shields Wilson Limited.




© Shields Wilson Limited.




© Shields Wilson Limited.




© Shields Wilson Limited.




© Shields Wilson Limited.






© Shields Wilson Limited.






© Shields Wilson Limited.






© Shields Wilson Limited.




© Shields Wilson Limited.






© Shields Wilson Limited.

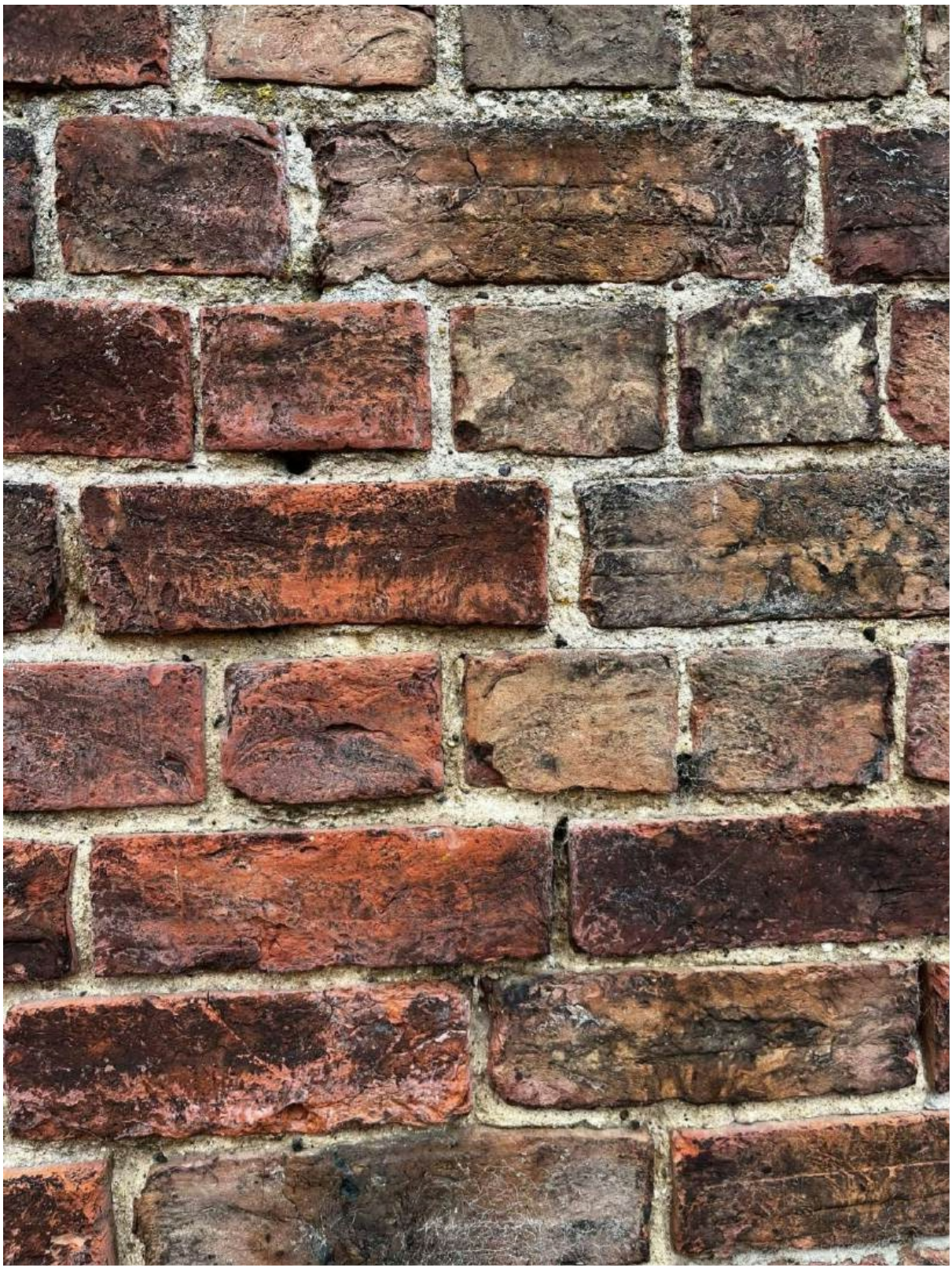



© Shields Wilson Limited.






© Shields Wilson Limited.




© Shields Wilson Limited.






© Shields Wilson Limited.




© Shields Wilson Limited.






© Shields Wilson Limited.




© Shields Wilson Limited.




© Shields Wilson Limited.




© Shields Wilson Limited.




© Shields Wilson Limited.




© Shields Wilson Limited.




© Shields Wilson Limited.




© Shields Wilson Limited.




© Shields Wilson Limited.




© Shields Wilson Limited.





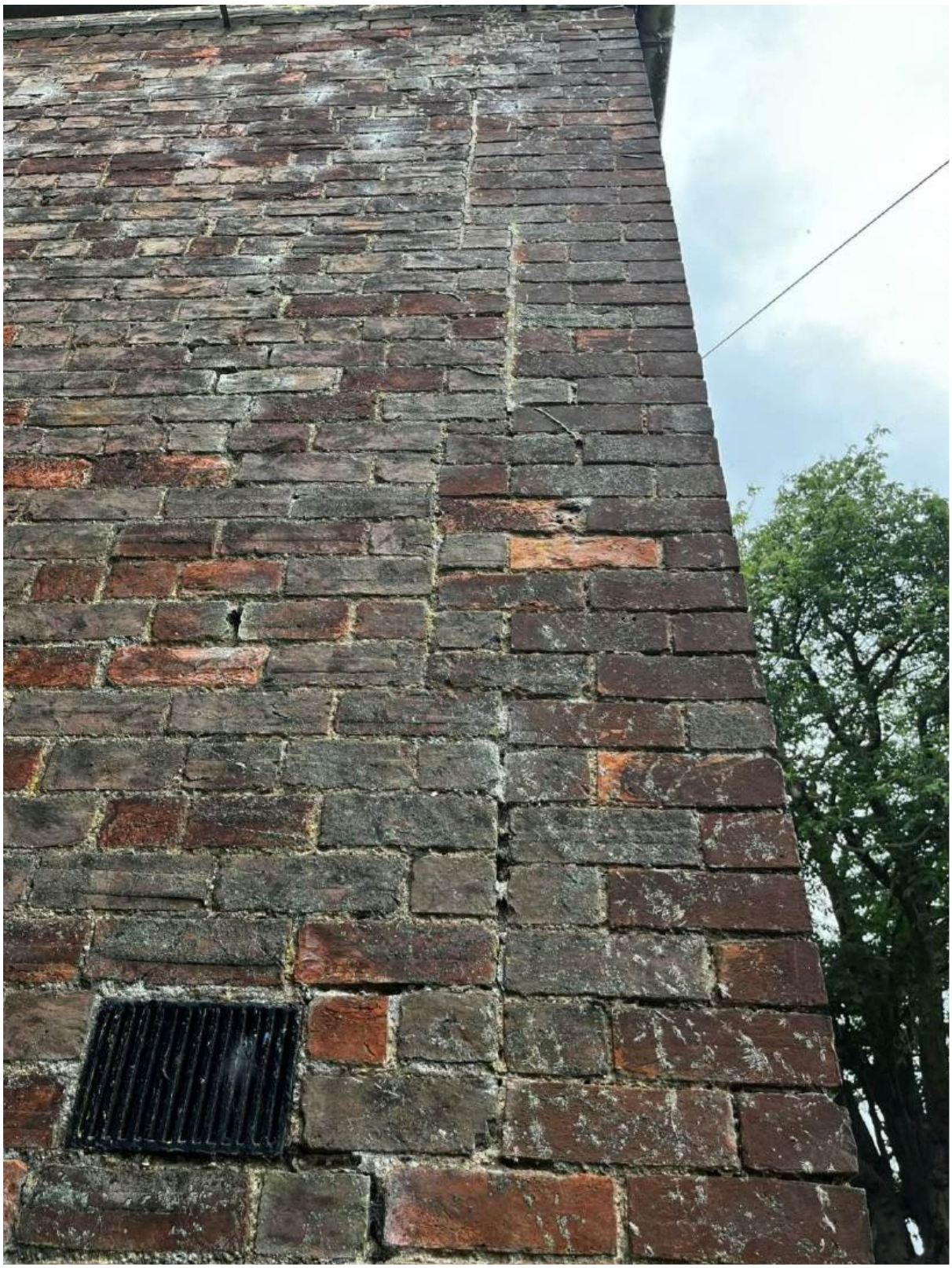

© Shields Wilson Limited.




© Shields Wilson Limited.




© Shields Wilson Limited.




© Shields Wilson Limited.




© Shields Wilson Limited.